

Seema Kushwaha

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WORK EXPERIENCE

- **Assistant Professor** February 1, 2019- till date
 - **Institute:** Indian Institute of Information Technology, Allahabad
 - **Department:** Department of Applied Sciences
- **Post Doctoral:** March 20, 2017-January 31, 2019
 - **Institute:** Harish-Chandra Research Institute, Allahabad, India.
 - **Research area:** Algebra & Number Theory.

EDUCATION

- **Doctor of Philosophy:** July 2011-January 2017
 - **Thesis supervisor:** Dr. Ritumoni Sarma
 - **Institute:** Indian Institute of Technology Delhi, India.
 - **Research area:** Number Theory.
 - **Research topic:** Continued fractions.
 - **C.G.P.A :** 9.538 on a 10 point scale in pre-PhD course work.
 - **Thesis Viva-voce:** January 30, 2017.
 - **Thesis title:** A study of continued fractions arising from subgraphs of the Farey graph.
 - **Research Summary:** My research work as a PhD scholar in IIT Delhi is a study of “continued fractions arising from certain graphs (subgraphs of the Farey graph)”, which is a part of Number Theory and involves some knowledge of Graph Theory. The relation between the “Farey graph” and continued fractions is not new, the correspondence between regular continued fractions and the Farey graph is available in the literature. Regular continued fractions may be viewed as a tool for deciding irrationality of a real number. Solving Diophantine equations (namely, Pell’s equation) is an important application of regular continued fractions. Moreover, convergents of an irrational number correspond to the best rational approximations of the number. These properties of regular continued fractions motivate to explore more on continued fractions arising from graphs.

We study the Farey graph and certain subgraphs of the Farey graph which are referred to as generalized Farey graphs. In the literature, the generalized Farey graphs are denoted by $\mathcal{F}_{u,N}$ where $u, N \in \mathbb{N}$ with $(u, N) = 1$. We associate certain continued fractions to these graphs when they are connected. Association of continued fractions to a graph is seen with the help of certain paths from infinity in the respective graph. We give a geometric interpretation of partial numerators and denominators in each case and formulate algorithms to find the $\mathcal{F}_{1,2}$ and an $\mathcal{F}_{1,3}$ -continued fraction expansion of a real number. Further, we study approximation properties of real numbers through these continued fractions.

We introduce for every $N \in \mathbb{N}$, a subgraph \mathcal{F}_N of the Farey graph which has the same set of vertices as $\mathcal{F}_{1,N}$. We show that \mathcal{F}_N is connected if and only if N is either 1 or a prime power. We extract and study continued fractions associated to \mathcal{F}_{p^l} , where p is a prime and $l \in \mathbb{N}$.

We revisit the Farey graph and designate certain paths from infinity in the Farey graph as “well-directed paths”. We show that a well-directed path from infinity has almost strictly increasing denominators and every semi-regular continued fraction corresponds to a unique well-directed path in the Farey graph from infinity to its value and conversely.

We introduce several other types of semi-regular continued fractions and study their existence and uniqueness for every real number.

- **Master of Science in Mathematics:** 2009-2011
 - **Institute:** Indian Institute of Technology Kanpur, India.
 - **C.G.P.A.:** 8.0 on a 10 point scale.
 - **Courses studied:** Linear algebra, Analysis, Algebra, Probability and Statistics, Measure theory, Biomathematics, Computer programming and data, Principles of numerical computation, Differential geometry, Introduction to continuum mechanics, Ordinary differential equations, Complex analysis, Functional analysis, Topology etc.

- **Bachelor of Science (General):** 2006-2009
 - **College:** P.P.N. College, Kanpur.
 - **University:** C.S.J.M. University, Kanpur, U.P.
 - **Percentage secured:** 70.5%
 - **Subjects:** Mathematics, Physics, Chemistry.

- **Intermediate (Science stream, Mathematics),** 2004-2006
 - **School :** P. D. Khanna Inter College, Kanpur, U.P.

- **Board :** U. P. Board.
- **Percentage secured:** 80.2%
- **High School, 2002-2004**
 - **School :** G. N. B. Higher Secondary School, Kanpur, U.P.
 - **Board :** U. P. Board.
 - **Percentage secured:** 78.2%

RESEARCH WORK

- Kushwaha, Seema. Pell Equations & \mathcal{F}_{p^t} -Continued Fractions. J. Math. (2022).
- Kushwaha, Seema Pell equation: a revisit through periodic \mathcal{F}_{2^t} -continued fractions. Integers 20A (2020), Proceedings of the Integers Conference 2018, Paper No. A9, 13 pp.
- Kushwaha, S.; Sarma, R. Continued fractions arising from $\mathcal{F}_{1,3}$. Ramanujan J. 46 (2018), no. 3, 605–631.
- Sarma, Ritumoni; Kushwaha, Seema On finite semi-regular continued fractions. Integers 16 (2016), Paper No. A45, 11 pp.
- Sarma, R.; Kushwaha, S.; Krishnan, R. Continued fractions arising from $\mathcal{F}_{1,2}$. J. Number Theory 154 (2015), 179–200.
- R. Sarma and S. Kushwaha, “**Paths from Infinity in the Farey Graph and Semiregular Continued Fractions**”, under review.
- S. Kushwaha and R. Sarma, “**Farey-subgraphs and Continued Fractions**”, under review.
- S. Kushwaha, “**The $\mathcal{F}_{1,2}$ -Continued Fraction Expansion of $e^{1/S}$** ”, communicated.
- S. Kushwaha, “**On Periodic \mathcal{F}_{2^n} -Continued Fractions**”, communicated.

SOFTWARES AND TECHNICAL LANGUAGES KNOWN

- Worked on softwares MATLAB, Mathematica.
- Having basic knowledge of technical language C.

SCHOLASTIC
ACHIEVEMENTS

- Selected for HRI-Fellowship for Post Doctoral.
- Cleared UGC-JRF (Junior Research Fellowship), June 2012 with All India Rank 102.
- Cleared CSIR-NET (Eligibility for Lectureship), June 2011 with All India Rank 51.
- Cleared GATE (Graduate Aptitude Test for Engineering), 2011 and received GATE fellowship from IIT Delhi.
- Cleared JAM (Joint Admission Test for M.Sc.).

ACADEMIC VISITS
AND WORKSHOPS

- I have attended a conference **International Conference on Class Groups of Number Fields and Related Topics-2**, held in HRI, Allahabad (October 8-11, 2018).
- I have attended a conference **Integers Conference-2018**, held in Augusta University, Georgia, USA (October 3-6, 2018).
- I have attended a conference **83-rd Annual Conference of IMS**, held in SVU, Tirupati (Dec 12-15, 2017) and delivered a contributed talk.

- I have attended a conference **International Conference on Class Groups of Number Fields and Related Topics**, held in HRI, Allahabad (September 4-7, 2017).
- I have attended a conference **Indian Women and Mathematics 2017**, held in IISc Bangalore (July 13-15, 2017) and delivered a contributed talk.

- I have attended a conference “**National Conference on Algebra, Analysis, Coding and Cryptography**”, held in University of Delhi, 2016.

- I have attended an international conference **7-th European Congress of Mathematics 2016, Berlin**, held in Berlin (July 18-22, 2016) and presented a poster.

PERSONAL
DETAILS

Name : Seema Kushwaha
Father's name : Sudarshan Kumar Kushwaha
Mother's name : Soni Devi
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LIST OF REFEREES

(1) **Dr. Ritumoni Sarma**

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Department of Mathematics
Indian Institute of Technology Delhi, Delhi-110016.
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- **Contact No.:** (91)-11-26591446

(2) **Dr. Krishnan Rajkumar**

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School of Computer and Systems Sciences
Jawaharlal Nehru University, Delhi - 110067.
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(3) **Dr. Chandan Singh Dalawat**

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(4) **Dr. R. K. Sharma**

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